

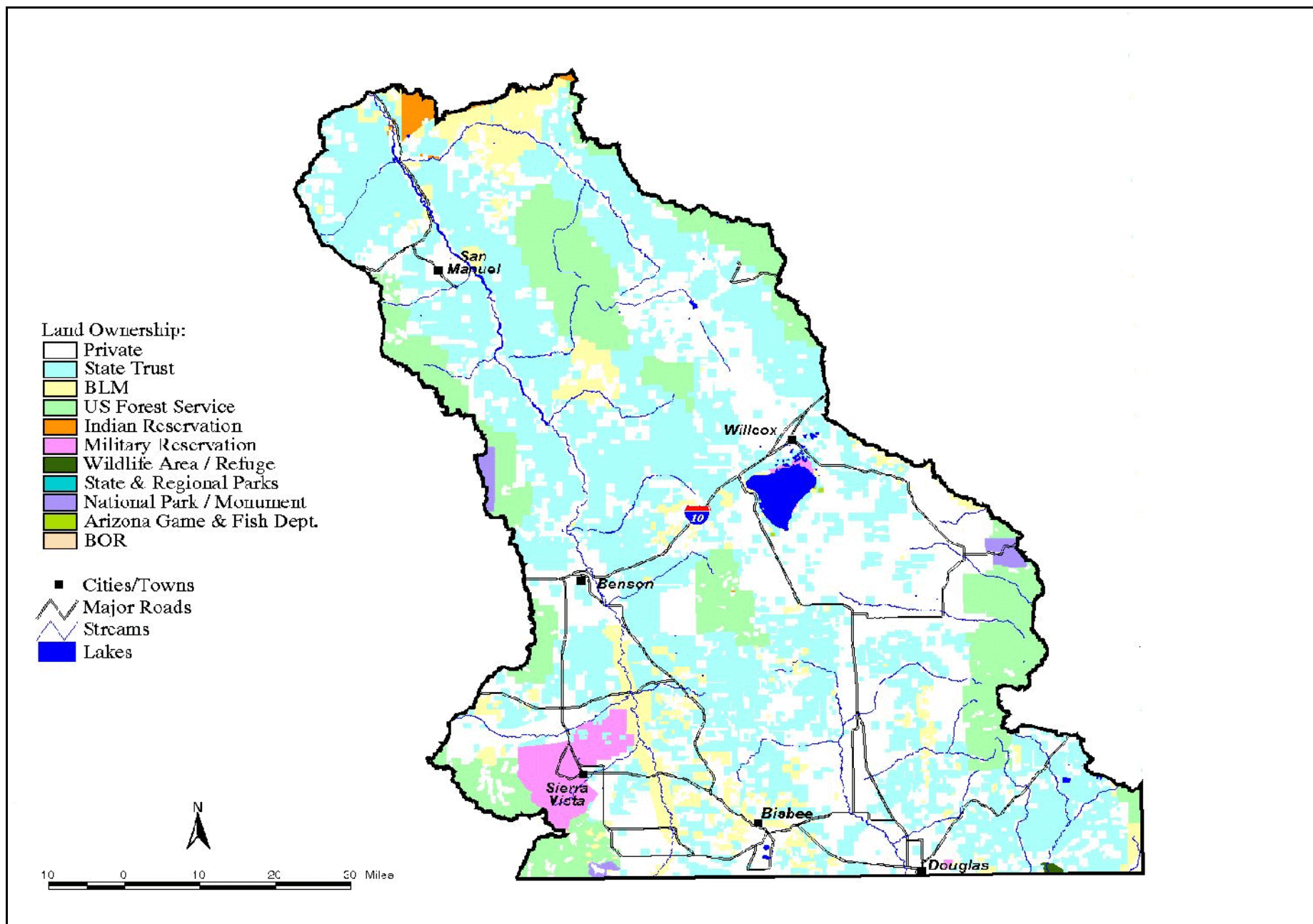
## San Pedro-Willcox Playa-Rio Yaqui Watershed



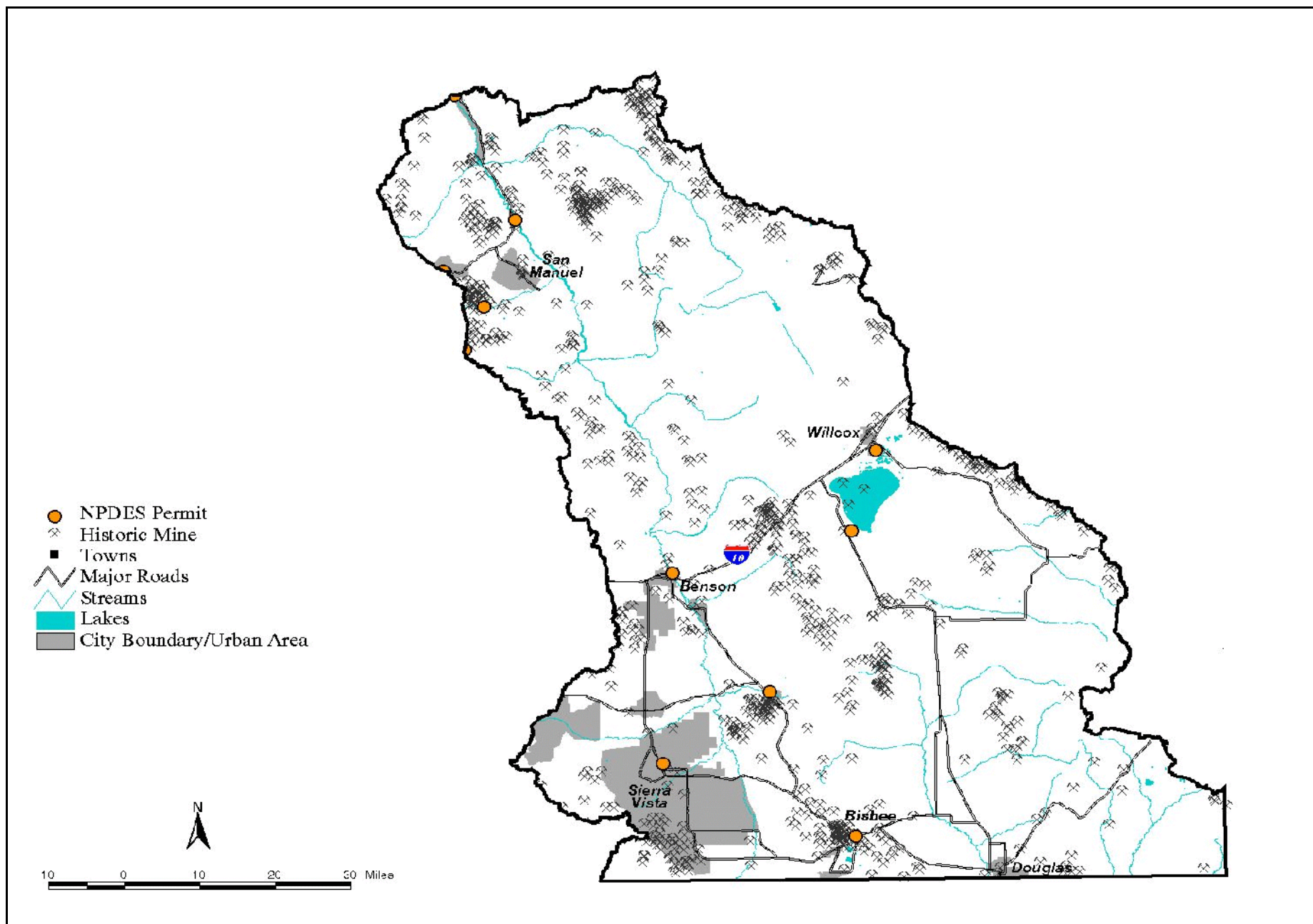
## SAN PEDRO-WILLCOX PLAYA-RIO YAQUI WATERSHED CHARACTERISTICS

SIZE	7,015 square miles (6% of the State's land area).					
POPULATION BASE	Approximately 130,000 people live in this watershed (estimated from the 2000 census). This is about 2.5% of the state's population					
LAND OWNERSHIP (Figure 39)	Private land	38%	Bureau of Land Management	5%	Military land	4%
	State Land Dept.	38%	U.S. Forest Service	14%	Other state and federal	1%
LAND USES AND PERMITS (Figure 40)	<p>Communities in this watershed include rapidly growing Sierra Vista and historic landmarks such as Tombstone, Douglas, and Bisbee . Grazing is widespread in this watershed, with significant areas with irrigated agriculture along the eastern side. Historic copper, silver, and gold mining occurred across the watershed; however, there are only a few active mines and mining activity reflects current market values.</p> <p>The San Pedro Riparian National Conservation Area managed by the Bureau of Land Management was the nation's first such area. It received this designation in 1988 to protect a 56,000 acre area along the upper San Pedro River.</p>					
HYDROLOGY AND GEOLOGY	<p>Three hydrologically distinct surface water basins occur within this watershed: 1) The San Pedro River flows north from Mexico almost 100 miles to the Gila River, and contains many riparian areas that support rich wildlife populations; 2) The Willcox Playa is a terminal basin, so that all surface water drainage within this basin is ultimately collected in the playa; and 3) The Rio Yaqui basin contains Whitewater Draw and Black Draw with both drainages flowing south into Mexico. Flow on the San Pedro River at Charleston varies between 0.22 cfs (in 1990) to 98,000 (in 1926) (USGS 1996). Ground water pumping has limited the perennial flow of the San Pedro River flows to approximately 25 miles near the Mexican border (Brown et al. 1978).</p> <p>Diverse vegetation ranges from desert grassland at low elevations (4,000 feet above sea level) to alpine forest in the Pinaleno Mountains, which rise to 10,700 feet above sea level at Mount Graham. The geology is characterized by mountain ranges that trend to the northwest, separated by broad alluvial valleys and three kinds of aquifers. This is typical of the Basin and Range Hydrologic Province that this watershed is included within.</p> <p>Several ground water basins occur in this watershed, including: Aravaipa Canyon, Douglas, San Bernadino Valley, Upper San Pedro, Willcox Playa, most of the Lower San Pedro, and a small portion of Cienega Creek. The consolidated bedrock of the mountains that divide the ground water basins has small localized aquifers (created by fault zones). They provide only enough water for low-use domestic and stock wells. The main ground water source is provided by alluvial basin-fill sediments. Wells in these aquifers can produce more than 2,000 gallons per minute. Also, streambed alluvial aquifers produce well yields up to 1,800 gallons per minute (ADWR 1994).</p>					
UNIQUE WATERS	Aravaipa Canyon Creek and Buehman Canyon Creek					
ECOREGIONS	Southern Deserts, except the northern edge that is in the Southern Basin and Range.					
OTHER STATES, NATIONS, OR TRIBES	This watershed primarily receives drainage from Mexico on the south and New Mexico on the east. However, the drainage from Whitewater Draw and Black Draw flows into Mexico. No tribal lands occur in this watershed.					





**Figure 39. Land Ownership in the San Pedro-Willcox Playa-Rio Yaqui Watershed**



**Figure 40. General Land Use and NPDES Permits in the San Pedro-Willcox Playa-Rio Yaqui Watershed**

## San Pedro-Willcox Playa-Rio Yaqui Watershed Assessment Discussion

### Statistical Summary of Surface Water Assessments

**Assessments** – For the 2002 assessment, 244 miles of streams or washes and 10 acres of lakes were assessed. This assessment includes the water quality monitoring data collected in 2000 when this was one of two focus watersheds.

Water quality assessment information for the San Pedro-Willcox Playa-Rio Yaqui Watershed is summarized in the following tables and illustrated on **Figure 41**.

**Table 21. Assessments in the San Pedro-Willcox Playa-Rio Yaqui Watershed – 2002**

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	200	15	0	0
INCONCLUSIVE	14	3	10	2
IMPAIRED	30	5	0	0
NOT ATTAINING	0	0	0	0
TOTAL ASSESSED	244	23	10	2

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	206	14	10	2

\* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

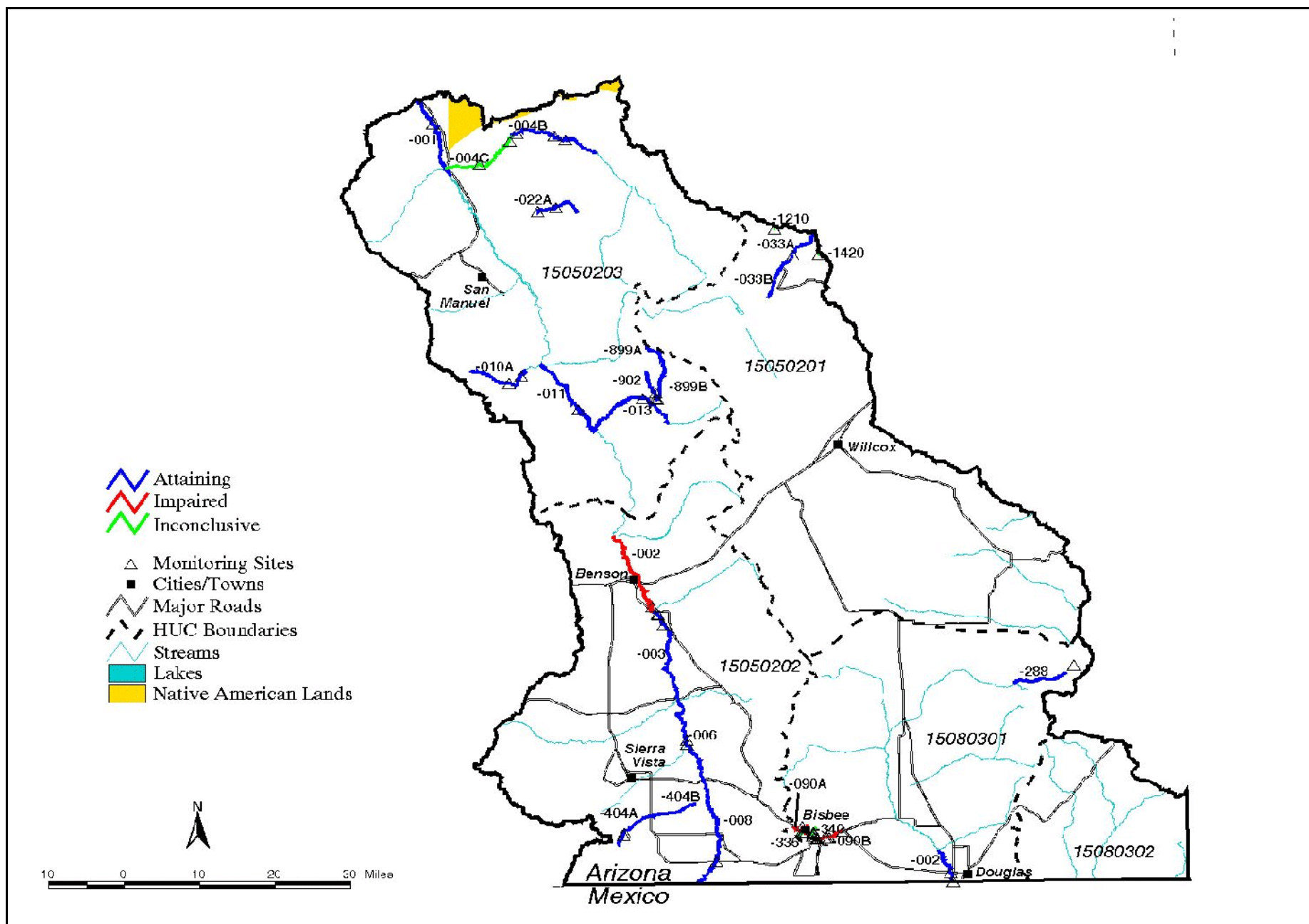
**Inconclusive Assessments** – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring

cycle (scheduled in 2005), ADEQ expects to monitor most of the surface waters on the Planning List so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack water quality monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and other state and federal agencies to collected monitoring data, so that their future monitoring efforts will better support Arizona's surface water assessments.

**Major Stressors** – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are indicated. Impaired reaches can be divided into two problems:

- < High nitrate levels seeping into the San Pedro River due to ground water contamination at the Apache Powder Superfund cleanup site; and
- < Historic mining activities in the Bisbee, Arizona area that has lead to copper, zinc and low pH contamination of Mule Gulch and its tributaries.



**Figure 41. San Pedro-Willcox Playa-Rio Yaqui Watershed Surface Water Assessments – 2002**

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Aravaipa Canyon Creek headwaters-Stowe Gulch AZ15050203-004A A&Ww, FC, FBC, DWS, AgL	ADEQ Stream Ecosystem Monitoring Near springs SPARA012.45 100209	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Aravaipa Canyon Creek Stowe Gulch-Wilderness AZ15050203-004B A&Ww, FC, FBC, DWS, AgL	ADEQ Ambient and Bioassessment At Hells Half Acre (West end) SPARA007.92 100716	1997 - 1 suite(no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Ambient and Bioassessment Below Parson's Canyon SPARA010.40 100211	1997 - 1 suite (no bacterial samples) 1998 - 1 suite (no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Stream Ecosystem Monitoring At east trail head SPARA011.03 100210	1998 - 1 suite 2000 - 1 suite  (no bacterial samples)	OK					
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1997 - 2000  13 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 13 samples at 3 sites in 1997 - 2000. Reach assessed as “attaining all uses.”
Aravaipa Canyon Creek Wilderness Area-San Pedro AZ15050203-004C A&Ww, FC, FBC, DWS, AgL	ADEQ Ecosystem Monitoring 5 miles from terminus SPARA002.96 100213	1998 - 1 suite	OK					Missing core parameters: bacteria.
	ADEQ Ecosystem Monitoring At Woods Ranch SPARA006.75 100212	1998 - 1 suite 2000 - 1 suite	OK					Missing core parameters: bacteria.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	1997 - 2000  3 samples 2 sampling events Missing a core parameter	OK				Attaining	ADEQ collected a total of 3 samples at 2 sites from 1998 - 2000. Reach assessed as “inconclusive” and added to the Planning List due to lack of sampling events and missing bacteria samples.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Bass Canyon Creek headwaters-Hotsprings AZ15050203-899 A&Ww, FC, FBC	ADEQ Stream Ecosystem Monitoring Above Hot Springs Cyn Creek SPBAS000.24 100217	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Fixed Station Network Above Double R Canyon SPBAS000.75 100215	2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring At stream length 9.2 miles SPBAS001.54 100214	1998 - 1 suite	OK					Missing core parameters: bacteria
	<b>Summary Row</b> <b>A&amp;Ww     Attaining</b> <b>FC         Attaining</b> <b>FBC         Attaining</b>	<b>1998 - 2000</b> <b>7 samples</b> <b>6 sampling events</b>	<b>OK</b>				<b>Attaining</b>	<b>ADEQ collected a total of 7 samples at 3 sites from 1998 - 2000. Reach assessed as "attaining all uses."</b>
Unnamed trib. to Bass Canyon headwaters - Bass Canyon Cr. AZ15050203-935 A&Ww, FBC, FC	ADEQ Stream Ecosystem Monitoring Unnamed-east of Bass Canyon Creek SPUBS000.20 100224	1998 - 1 suite	OK					Missing core parameters: mercury and bacteria.
	<b>Summary Row</b>	<b>1998</b> <b>1 sampling event</b>	<b>OK</b>				<b>Not assessed</b>	<b>Insufficient sampling events to assess.</b>
Brewery Gulch Wildcat Canyon-Mule Gulch AZ15080301-337 A&We, PBC	ADEQ TMDL Program Above mineralized zone RMBRG000.90	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	9 (A&We)	26	1 of 1		
	ADEQ TMDL Program At Mule Gulch RMBRG000.01	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	52 - 150	4 of 4		
	<b>Summary Row</b> <b>A&amp;We     Impaired</b> <b>PBC       Inconclusive</b>	<b>2000</b> <b>5 samples</b> <b>4 sampling events</b>  <b>Missing core parameters</b>	<b>Copper (dissolved)</b> <b>µg/l</b>	<b>Varies (A&amp;We)</b>	<b>26 - 150</b>	<b>5 of 5</b>	<b>Impaired</b>	<b>ADEQ collected a total of 5 samples at two sites in 2000. Reach assessed as impaired due to copper.</b>



**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Buehman Canyon headwaters-end Unique Waters AZ15050203-010A A&Ww, FC, FBC, AgL Unique Waters	ADEQ Ambient Monitoring 2 miles below Bullock Canyon SPBHC002.46 100425	1996 - 1 suite 2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	2.38-8.26 (31- 98% saturation)	3 of 5		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs) and ground water upwelling. Not included as exceedance in final assessment.
	ADEQ Fixed Station Network Above USFS Road 801 SPBHC003.90 100272	1996 - 5 suites 1997 - 4 suites  (no bacterial samples)	Beryllium (total) µg/l	0.21 FC	1.3-2.0	8 of 8		Two other beryllium samples were not used because the Laboratory Reporting Limit was too high
			Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.42-7.78 (57- 91% sat)	2 of 6		Naturally occurring low dissolved oxygen due to ground water up-welling. Exceedances not included in final assessment.
	<b>Summary Row</b> A&Ww <b>Attaining</b> FC <b>Inconclusive</b> FBC <b>Attaining</b> AgL <b>Attaining</b>	<b>1996 - 2000</b>  <b>14 sampling events</b>	<b>Beryllium (total)</b> µg/l	<b>0.21</b> FC	<b>1.3-2.0</b>	<b>8 of 8</b>	<b>Inconclusive</b>	<b>ADEQ collected a total of 14 samples at t two sites from 1996 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to beryllium exceedances.</b>
C - Canyon headwaters- Mule Gulch AZ15080301-342 A&We, PBC	ADEQ TMDL Program At Highway 80 RMCCN000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	47 (A&We)	55	1 of 1		
	<b>Summary Row</b>	<b>2000</b>  <b>1 sampling event</b>	<b>Copper</b> <b>(dissolved)</b> µg/l	<b>47</b> <b>(A&amp;We)</b>	<b>55</b>	<b>1 of 1</b>	<b>Not assessed</b>	<b>Insufficient sampling events and parametric coverage to assess. Add to Planning List due to copper exceedance.</b>
Copper Creek headwaters-Prospect Canyon AZ15050203-022A A&Ww, FC, FBC, AgL	ADEQ Ambient Monitoring Above Bluebird Mine drainage SPCOP007.09 100433	1998 - 1 suite (no bacteria) 2000 - 3 suites	OK					
	ADEQ Fixed Station Network Below Dark Canyon SPCOP005.80 100944	2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	5.95 - 9.91 (84% - 101% saturation)	1 of 4		Exceedance within equipment tolerance interval of +/- 0.2 mg/L. Exceedance not included in final assessment.
	<b>Summary Row</b> A&Ww <b>Attaining</b> FC <b>Attaining</b> FBC <b>Attaining</b> DWS <b>Attaining</b> AgL <b>Attaining</b>	<b>1998 - 2000</b>  <b>8 sampling events</b>	<b>OK</b>				<b>Attaining</b>	<b>ADEQ collected a total of 8 samples at two sites from 1998 - 2000. Reach assessed as "attaining all uses."</b>
Double R Canyon Creek headwaters-Bass Cyn Creek AZ15050203-902 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Near Terminus SPDOU000.20 100223	1998 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.67 - 6.2 (59 - 70% saturation)	1 of 2		Missing core parameters: bacteria

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Ambient Monitoring At stream length 4.2 miles SPDOU001.00 100222	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.72 (61% saturation)	1 of 1		Missing core parameters: bacteria
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Attaining AgL Attaining	1998 - 2000 3 sampling events Missing core parameters	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.67 - 6.2 (59 - 70% saturation)	2 of 3	Inconclusive	ADEQ collected a total of 3 samples at two sites from 1998 - 2000. Reach assessed as "attaining some uses" and added to Planning List due to low dissolve oxygen test results and missing bacteria samples.
Dubacher Canyon headwaters to Mule Gulch AZ15080301-075 A&We, PBC	ADEQ TMDL Program Below Highway 80 RMDBC000.01	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	36,000 - 78,000	2 of 2		
			pH(low) SU	6.5-9.0 (A&We, PBC)	2.3	1 of 1		
	Summary Row A&We Impaired PBC Inconclusive	2000 2 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	36,000- 78,000	2 of 2	Impaired	ADEQ collected a total of 2 samples at one site in 2000. Reach assessed as "impaired" due to copper and zinc. Also added to the Planning List due to low pH reading and missing core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	2.3	1 of 1	Inconclusive	
Grant Creek headwaters-High Creek AZ15050201-033 A&Wc, FC, FBC, DWS, AgL	ADEQ Ambient Monitoring 1 mile below Post Creek WPGRA006.56 100561	1997 - 1 suite(no bacteria, fluoride) 2000 - 2 suites	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive DWS Inconclusive AgL Attaining	1997 - 2000 3 sampling events Missing core parameters	OK				Attaining	ADEQ collected 3 samples from 1997-2000. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Hendricks Gulch headwaters to Mule Gulch AZ15080301-335 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMHNG000.01	2000 - 3 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3		
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2		
	Summary Row A&We Inconclusive PBC Inconclusive	2000 3 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3	Inconclusive	ADEQ collected 3 samples in 2000. Reach assessed as "inconclusive" due to insufficient samples and core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2	Inconclusive	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Hot Springs Canyon Creek headwaters-San Pedro AZ15050203-013 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Southwest of Wildcat Peak SPHSC006.04 100220	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Ambient and Bioassessment Below Wildcat Canyon SPHSC006.13 100574	1997 - 1 suite (no bacterial samples) 2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring Below Bass Canyon Creek SPHSC006.22 100219	1998 - 1 suite	OK					Missing core parameters: bacteria
	<b>Summary Row</b> A&Ww    Attaining FC        Attaining FBC       Attaining AgL       Attaining	<b>1997 - 2000</b>  <b>8 samples</b>	OK				Attaining	ADEQ collected a total of 8 samples at 3 sites in 1997-2000. Reach assessed as "attaining all uses."
Morales Creek headwaters-Mule Gulch AZ15080301-331 A&We, PBC	ADEQ TMDL Program Lat 31E27°07.1" Long 109E56°26.9" RMMOR000.40	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	11 (A&We)	18	1 of 1		
	<b>Summary Row</b>	<b>2000</b>  <b>1 sample</b>	<b>Copper</b> <b>(dissolved)</b> <b>µg/l</b>	<b>11</b> <b>(A&amp;We)</b>	<b>18</b>	<b>1 of 1</b>	Not assessed	Insufficient sampling events to assess. Add to Planning List due to copper.
Miller Canyon Creek headwaters-San Pedro AZ15050202-409 A&Wc, FC, FBC, DWS, AgL	ADEQ Bioassessment Program Near headwaters SPMLC008.64 100592	1998 - 1 suite (no bacteria, total mercury, dissolved chromium/zinc)	OK					
	<b>Summary Row</b>	<b>1998</b>  <b>1 sampling event</b>	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.
Mule Gulch headwaters-WWTP AZ15080301-090A A&Ww, FC, PBC, Agl, AgL	ADEQ TMDL Program Above C-Canyon RMMLG005.10	1999 - 1 pH, copper, zinc	Copper (dissolved) µg/l	Varies (64) (A&Ww)	1,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (371) (A&Ww)	2,400	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.24	1 of 1		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ TMDL Program At traffic circle RMMLG005.26 100507	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	2,356-10,050	3 of 3		
			Copper (total) µg/l	500 (AgL)	1,762-10,500	3 of 3		
			Zinc (dissolved) µg/l	Varies (A&Ww)	2,040-3,760	3 of 3		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.4-5.5	3 of 3		
	ADEQ TMDL Program Above mill site RMMLG005.28	1999 - 1 pH, copper, zinc	Copper (dissolved) up/l	Varies (39) (A&Ww)	4,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.07	1 of 1		
	ADEQ TMDL Program At Castle Rock (MG-2) RMMLG005.94 100506	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program Below old mill site RMMLG011.25	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Ww)	4000	2 of 2		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240 - 430	2 of 2		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.0	1 of 1		
	ADEQ TMDL Program At Lavender Pit RMMLG012.11	2000 - 5 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	11 - 110	5 of 5		
			pH (low) SU	6.5-9.0 (A&Ww, PBC)	5.76 - 8.94	1 of 5		
	Summary Row  A&Ww    Impaired FC       Inconclusive PBC     Inconclusive AgI      Inconclusive AgL      Inconclusive	1998 - 1999  9 samples  Missing core parameters	Copper (dissolved) µg/l	Varies (A&Ww)	1,200 - 10,050	12 of 16	Impaired	ADEQ collected a total of 9 samples at four sites in 1998-1999. Reach assessed as impaired due to copper and zinc. Reach also added to the Planning List due to low pH and missing core parameters.
			Copper (total) µg/l	500 (AgL)	1,762 - 10,500	5 of 16	Inconclusive	
			Zinc (dissolved) µg/l	Varies (A&Ww)	240 - 3,760	7 of 16	Impaired	



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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.00 - 5.5	7 of 15	Inconclusive	
Mule Gulch WWTP-Whitewater Draw AZ15080301-090B A&Wedw, PBC, AgL	ADEQ TMDL Program At Elfrida cutoff RMMLG002.75 100225	1998 - 2 pH, copper, zinc	Copper (dissolved) µg/l	Varies (45-48) A&Wedw	76-118	2 of 2		
	ADEQ TMDL Program Below unnamed wash RMMLG004.22 100509	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (33-39) (A&Wedw)	43-85	3 of 3		
	ADEQ TMDL Program Below WWTP RMMLG004.50 100508	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program At MG-300 (a.k.a. FSN MG- 1) RMMLG007.12	1999 - 1 pH, copper, zinc 2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	62 - 12,000	3 of 5		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 1,900	2 of 5		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.16 - 8.58	2 of 5		
	ADEQ TMDL Program At MG-200 (old site) RMMLG009.26	1999 - 1 pH, copper, zinc 2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	10 - 7,300	1 of 2		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 2,600	1 of 2		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	4.15 - 8.08	2 of 2		
	ADEQ TMDL Program At MG-200 (new site) RMMLG009.28	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	110 - 10,000	4 of 4		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	110 - 2,600	4 of 4		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 7.90	3 of 4		
	Summary Row  A&Wedw Impaired PBC Impaired AgL Impaired	1998-2000  20 samples 4 sampling events  Missing core parameters	Copper (dissolved) µg/l	Varies (A&Wedw)	10 - 12,000	8 of 20	Impaired	ADEQ collected a total of 20 samples at six sites from 1998-2000. Reach assessed as "impaired" due to copper, zinc, and low pH.
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 8.08	7 of 20	Impaired	

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 2,600	7 of 20	Impaired	
Mural & Grassy Hill Tributary headwaters to Mule Gulch AZ15080301-344 A&We, PBC	ADEQ TMDL Program At Mule Gulch RMMHC000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	8 (A&We)	15	1 of 1		
	<b>Summary Row</b>	<b>2000 1 sample</b>	<b>Copper (dissolved) µg/l</b>	<b>8 (A&amp;We)</b>	<b>15</b>	<b>1 of 1</b>	<b>Not assessed</b>	<b>Insufficient sampling events and parametric coverage to assess.</b>
Paige Creek headwaters-San Pedro AZ15050203-823 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria program Below Hells Gate SPPAI007.50 100616	1996 - 1 suite	OK					
	<b>Summary Row</b>	<b>1996  1 sampling event</b>	<b>OK</b>				<b>Not assessed</b>	<b>Insufficient sampling events to assess.</b>
Ramsey Canyon Creek headwaters-San Pedro AZ15050202-404 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Ambient and Bioassessment Above Nature Conservancy SPRMC007.43 100625	1998 - 1 suite(no bacterial samples) 2000 - 2 suites	OK					
	ADEQ Fixed Station Network SPRMC007.18 101060	2000 - 2 suites	OK					
	<b>Summary Row</b>  A&Wc    Attaining FC        Attaining FBC       Attaining DWS       Attaining Agl        Attaining AgL        Attaining	<b>1998 - 2000  5 sampling events</b>	<b>OK</b>				<b>Attaining</b>	<b>ADEQ collected a total of 5 samples at 2 sites in 1998 - 2000. Reach assessed as "attaining all uses."</b>
Redfield Canyon headwaters-San Pedro River AZ15050203-014 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Below Sycamore Canyon SPRDC006.89	1997 - 1 suite (no bacteria or boron)	OK					No bacterial or boron samples included in parametric coverage.
	<b>Summary Row</b>	<b>1997  1 sampling event</b>	<b>OK</b>				<b>Not assessed</b>	<b>Insufficient sampling events to assess.</b>

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Rucker Canyon Creek headwaters- Whitewater Draw AZ15080301-288 A&Wc, FC, FBC, DWS, AgL	ADEQ Fixed Station Network Above upper-most campsite RMRUC005.63 100938	2000 - 4 suites	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	6.38 - 7.88 (77 - 95% saturation)	1 of 4		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedence in final assessment.
	<b>Summary Row</b> A&Wc <b>Attaining</b> FC <b>Attaining</b> FBC <b>Attaining</b> DWS <b>Attaining</b> AgL <b>Attaining</b>	<b>2000</b>  <b>4 samples</b>	<b>OK</b>				<b>Attaining</b>	<b>ADEQ collected 4 samples in 2000.</b> <b>Reach assessed as "attaining all uses."</b>
San Pedro River Mexico border-Charleston AZ15050202-008 A&Ww, FC, FBC, Agl, AgL	USGS Station #09471000 At Charleston SPSPR096.49 100747	1996 - 9 suites 1997 - 13 suites 1998 - 12 suites 1999 - 8 suites 2000 - 10 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.6-9.9	5 of 52		Missing core parameters: turbidity, and only 5 beryllium analyses performed.
	ADEQ Stream Ecosystem Monitoring At Charleston Road SPSPR096.49 100291	2000 - 1 suite	OK					
	ADEQ Fixed Station Network Near Palominas SPSPR113.55 100275	1996 - 4 suites 1997 - 3 suites 1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.58-10.1 (79% - 110% saturation)	1 of 15		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedence in final assessment.
			Beryllium µg/l	0.21 (FC)	0.61	1/1		15 other beryllium samples were not counted because the Laboratory Reporting Limit was too high.
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 17		
	<b>Summary Row</b> A&Ww <b>Attaining</b> FC <b>Inconclusive</b> FBC <b>Attaining</b> Agl <b>Attaining</b> AgL <b>Attaining</b>	<b>1996 - 2000</b>  <b>70 sampling events</b>	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.58-10.1 (79% - 110% saturation)	6 of 68	<b>Attaining</b>	<b>ADEQ and USGS collected a total of 70</b> <b>samples at two sites in 1996 - 2000.</b> <b>Reach assessed as "attaining some</b> <b>uses." Add to Planning List due to</b> <b>beryllium exceedance.</b>
			Beryllium µg/l	0.21 (FC)	0.61	1 of 1	<b>Inconclusive</b>	
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 18	<b>Attaining</b>	
San Pedro River Charleston-Walnut Gulch AZ15050202-006 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Below Graveyard Gulch SPSPR095.71 100653	2000 - 4 suites	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4		

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row  A&Ww Inconclusive FC Attaining FBC Attaining Agl Attaining AgL Attaining	2000  4 sampling events	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4	Inconclusive	ADEQ collected 4 samples at one site in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedance.
San Pedro River Babocomari -Dagoon Wash AZ15050202-003 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network 0.8 miles south of Hwy 80 SPSPR077.66 100281	2000 - 4 suites	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	39 - 660	1 of 4		
	Hargis & Assoc. CERCLA Monitoring Below Apache Nitrogen Prod. SPSPR079.71	1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Summary Row  A&Ww Attaining FC Attaining FBC Inconclusive Agl Attaining AgL Attaining	1998 - 2000  14 sampling events	<i>Escherichia coli</i> CFU/100 ml	580 (single sample maximum) FBC	39-660	1 of 4	Inconclusive	ADEQ collected 4 samples and Hargis & Associates collected 10 samples at separate sites in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria exceedance.
San Pedro River Dagoon Wash-Tres Alamos AZ15050202-002 A&Ww, FC, FBC, Agl, AgL	Hargis & Assoc. CERCLA Monitoring Above Apache Nitrogen Products SPSPR076.35	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 2 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Hargis & Assoc. CERCLA Monitoring Mid Apache Nitrogen Products SPSPR077.31	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 3 suites 2000 - 4 suites	Nitrate (as nitrogen) mg/l	10 (A&Ww)	0.43-22.6	5 of 20		Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Summary Row  A&Ww Impaired FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000  36 samples 19 sampling events  Missing core parameters	Nitrate (as N) mg/l	10 (A&Ww)	0.43-22.6	5 of 20	Impaired	Hargis and Associates collected a total of 36 samples at two sites in 1996 - 2000. Reach assessed as "impaired" due to nitrate and was added to the Planning List due to missing core parameters.
San Pedro River Hot Springs Cr.-Redfield Cyn. AZ15050203-011 A&Ww, FC, FBC, Agl, AgL	ADEQ Ambient Monitoring Program Near Cascabel SPSPR046.96 100289	2000 - 5 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.59 - 9.81 (63 - 93% saturation)	2 of 5		Naturally low dissolved oxygen due to ground water up-welling. Exceedance not included in final assessment.
			<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4		Flood conditions present.



**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgI)	5 - 6000	1 of 4		Flood conditions present.
			Turbidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5		Flood conditions present.
	<b>Summary Row</b>  A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	<b>2000</b>  5 sampling events	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4	Inconclusive	ADEQ collected 5 samples in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
			Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgI)	5 - 6000	1 of 4	Inconclusive	
			Turbidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5	Inconclusive	
San Pedro River Aravaipa Creek-Gila River AZ15050203-001 A&Ww, FC, FBC, AgL	ADEQ Ambient and Bioassessment Below Eskiminzin Wash SPSPR003.74 100726	1998 - 1 suite 2000 - 5 suites	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	3-600	1 of 4		
			Turbidity NTU	50	1.70 - 1000	1 of 6		
	<b>Summary Row</b>  A&Ww Inconclusive FC Attaining FBC Inconclusive AgL Attaining	<b>1998 - 2000</b>  6 sampling events	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	3-600	1 of 4	Inconclusive	ADEQ collected 6 samples in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
			Turbidity NTU	50 (A&Ww)	1.70 - 1000	1 of 6	Inconclusive	
Spring Canyon Creek headwaters to Mule Gulch AZ15080301-333 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMSPC000.10	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	OK					Missing core parameters.
	<b>Summary Row</b>	<b>2000</b>  1 sampling event	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.
Ward Canyon headwaters-Turkey Creek AZ15050201- 433 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Salisbury Canyon WPWRC000.31 100682	1998 - 1 suite	OK					
	<b>Summary Row</b>	<b>1998</b>  1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Winwood Canyon headwaters-Mule Gulch AZ15080301-340 A&We, PBC	ADEQ TMDL Program At Mural Hill Tributary RMWMC000.66	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	Copper (dissolved) µg/l	22 (A&We)	28	1 of 1		

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ TMDL Program Above Old Mill Site, Below Mineralized Zone RMWMC000.37	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	pH (low) SU	6.5-9.0 (A&We, PBC)	6.02	1 of 1		
	<b>Summary Row</b>	<b>2000</b>	<b>Copper (dissolved) µg/l</b>	<b>22 (A&amp;We)</b>	<b>28</b>	<b>1 of 2</b>	<b>Inconclusive</b>	ADEQ collected a total of 2 samples at 2 sites. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events, copper and pH exceedances, and missing core parameters.
	<b>A&amp;We Inconclusive PBC Inconclusive</b>	<b>2 samples 1 sampling event Missing core parameters</b>	<b>pH (low) SU</b>	<b>6.5-9.0 (A&amp;We, PBC)</b>	<b>6.02</b>	<b>1 of 2</b>	<b>Inconclusive</b>	
Whitewater Draw Mule Gulch-Mexico border AZ15080301-002 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At border with Mexico RMWHD005.99 100512	1998 - 4 pH, arsenic, beryllium, copper, lead, manganese, zinc	OK					
	ADEQ TMDL Program At International Border RMWHD0.016 101069	2000 - 1 arsenic, beryllium	OK					
	ADEQ TMDL Program At Highway 80 RMWHD001.33 100510	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	OK					
	<b>Summary Row</b>	<b>1998 - 2000</b>	<b>OK</b>					ADEQ collected a total of 6 samples at 3 sites in 1998-2000 as part of a TMDL investigation. Reach assessed as "attaining some uses" and added to the Planning List due to lack of core parameters.
	<b>A&amp;Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Attaining</b>	<b>6 sampling events</b>						
Whitewater Draw Elfrida Highway-Mule Gulch AZ15080301-004 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At Kings Highway RMWHD006.60 100229	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	Lead (total) µg/l	100 (AgL)	116	1 of 1		Missing core parameters.
	<b>Summary Row</b>	<b>1998</b>	<b>Lead (total) µg/l</b>	<b>100 (AgL)</b>	<b>116</b>	<b>1 of 1</b>	<b>Not assessed</b>	<b>Insufficient sampling events to assess.</b>
<b>LAKE MONITORING DATA</b>								
Riggs Flat Lake AZL15050201-1210 A&Wc, FC, FBC, Agl, AgL	ADEQ Lakes Program WPRIG-A 100074	1998 - 2 suites	Turbidity NTU	10 (A&Wc)	0.8-17.4	1 of 1		Missing core parameters: Escherichia coli

**TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT**

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	<b>Summary Row</b>  A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998  2 sampling events  Missing core parameters	Turbidity NTU	10 A&Wc	0.8-17.4	1 of 1	Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.
Snow Flat Lake AZL15050201-1420 A&Wc, FBC, FC, Agl, AgL	ADEQ Lake Program WPSNO-A 100084	1998 - 2 suites	OK					Missing core parameters: Escherichia coli
	<b>Summary Row</b> A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998  2 samples  Missing core parameters	OK				Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.

**Information for interpreting these Monitoring Tables**

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1<sup>st</sup> through September 30<sup>th</sup>, rather than the calendar year. Types of samples:
  - < "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - < "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - < If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - < Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
  - < "OK" indicates that no standards were exceeded.
  - < The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - < "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - < A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

## Ground Water Assessments in the San Pedro-Willcox Playa-Rio Yaqui Watershed

**Major Ground Water Pollutants** -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 23** and illustrated in **Figures 42, 43, and 44**.

Of approximately 246 wells monitored, 18 exceeded fluoride standards, 12 exceeded standards for metals, 7 exceeded standards for radiochemicals, and 7 exceeded nitrate standards. **Figure 42** illustrates the location of the wells monitored and the wells exceeding standards. Exceedances occurred across the watershed, rather than in an isolated area; however, most of the radiochemical and fluoride exceedances occurred in the northern half of the watershed.

**TDS Concentrations** -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (23% of wells monitored), and TDS over 1000 mg/L will limit its use for some crops (7% of wells monitored). As illustrated in **Figure 43**, the elevated TDS is scattered across the watershed.

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

**Nitrate Concentrations** -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. A total of 27 wells of the 236 wells sampled (11%) exceeded the 5 mg/L concentration. As illustrated in **Figure 44**, elevated nitrates occur in the Willcox Playa area and scattered across the southern portion of this watershed. Irrigated agriculture, septic systems, and other wastewater disposal facilities are may be sources of this nitrate.

When nitrate concentrations exceed 10 mg/L, the water may present a health problem for babies and should not be consumed by nursing mothers. Seven wells exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize

further contamination of ground water by nitrate.



**Table 23. San Pedro-Willcox Playa-Rio Yaqui Watershed Ground Water Monitoring 1996 - 2000**

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	54		5	9%
	Fluoride	126		4	3%
	Metals/Metalloids	126		0	0%
	Nitrate	126		5	4%
	VOCs + SVOCs*	62	4	0	0%
	Pesticides	62	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	38		2	5%
	Fluoride	115		14	12%
	Metals/metalloids	120		12	10%
	Nitrate	110		2	2%
	VOCs + SVOCs*	37	0	0	0%
	Pesticides	37	0	0	0%

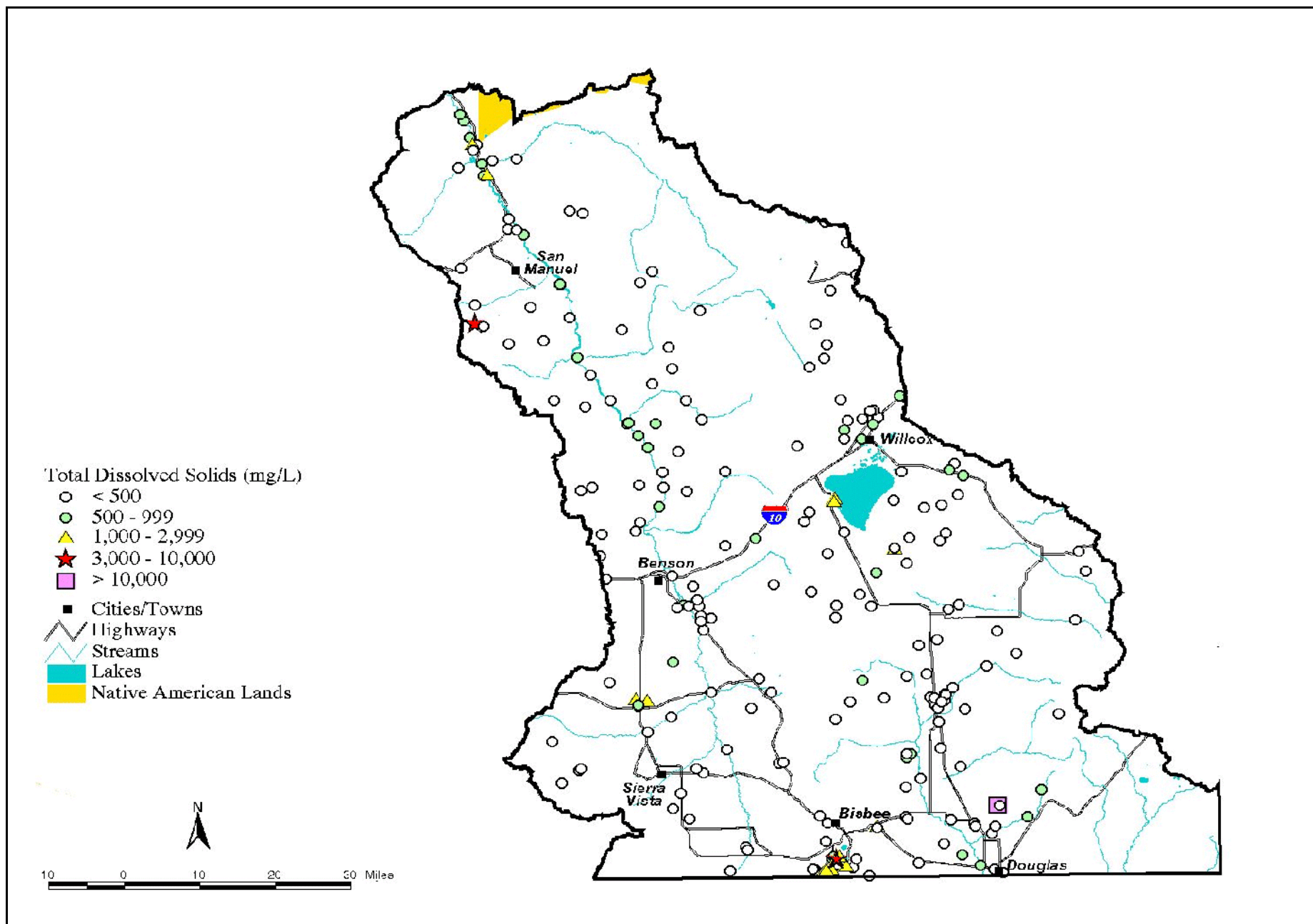
WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
223	172	36	12	3

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
236	209	20	7

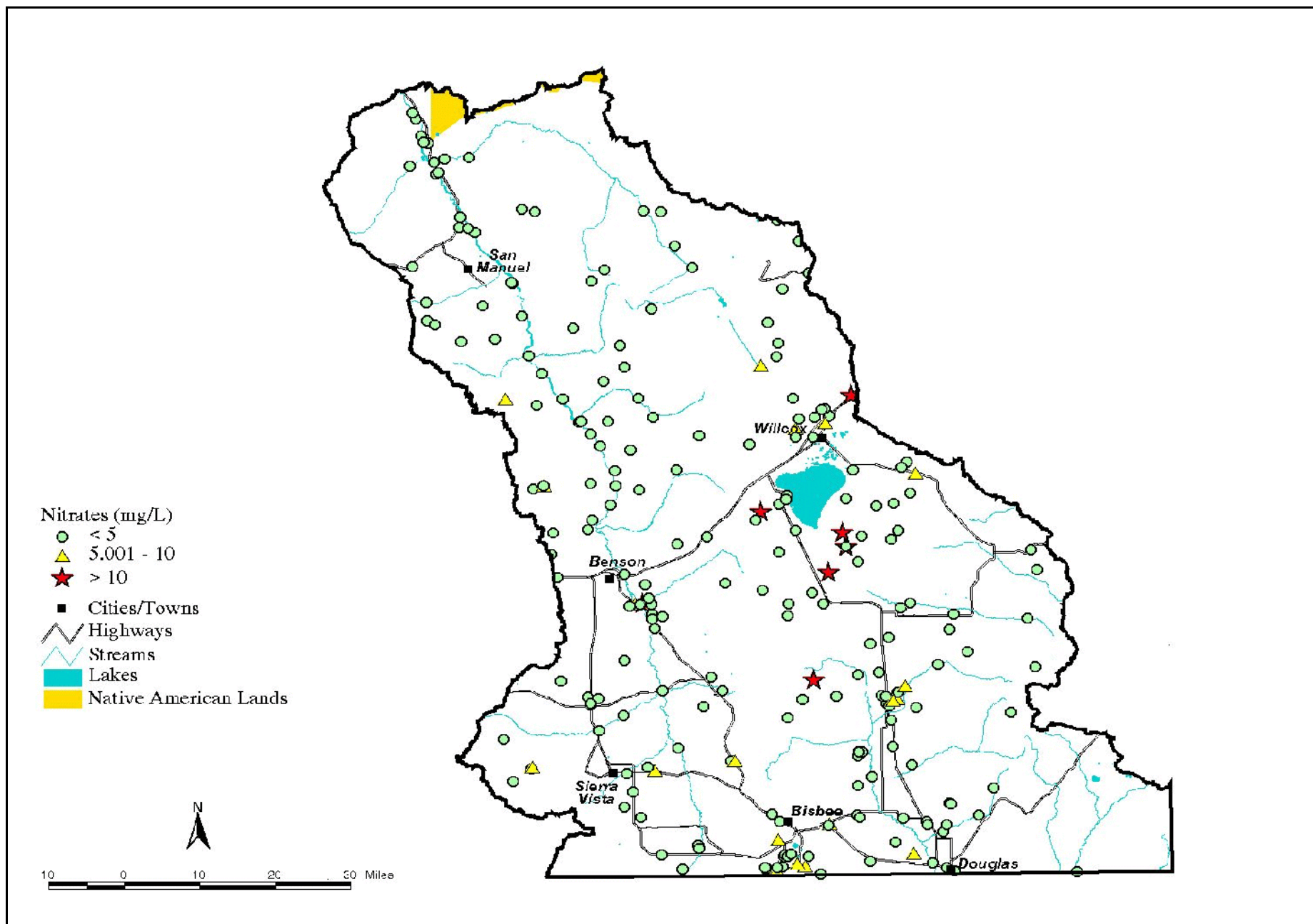
\*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

\*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.





**Figure 43. Classification of Ground Water Quality by TDS Concentration in the San Pedro-Willcox Playa-Rio Yaqui Watershed**



**Figure 44. Classification of Ground Water Quality by Nitrate Concentration in the San Pedro-Willcox Playa-Rio Yaqui Watershed**

# Watershed Studies and Alternative Solutions in the San Pedro-Willcox Playa-Rio Yaqui Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the San Pedro-Willcox Playa-Rio Yaqui Watershed. Watershed partnerships active in this watershed are also discussed.

## Surface Water Studies and Mitigation Projects

**Total Maximum Daily Load Analyses** – Two TMDL studies are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771- 4468, or at ADEQ's web site:

<http://www.adeq.state.az.us/environ/water/assess/tmdl.html>

- Mule Gulch TMDL – Mule Gulch was included on the 1998 303(d) List due to impairment by copper, zinc, and low pH. To develop a TMDL for this surface water, eighteen water samples have been collected since 1998 from seven sites along Mule Gulch from its headwaters to Whitewater Draw. ADEQ expects to complete a draft TMDL in the Fall of 2001.

**NAWQA Study** – Samples were collected in this watershed as part of the US Geological Survey's National Water Quality Assessment Program. This study included sites in the Middle Gila, Santa Cruz-Rio Magdalena-Rio Sonoyta, and Verde watersheds. See the discussion of this research effort in the statewide studies section at the beginning of Volume II.

**Water Protection Fund Projects** – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- San Pedro Riparian National Conservation Area Watershed Rehabilitation and Restoration Project – The Bureau of Land Management (BLM) was awarded funds to rehabilitate and restore approximately 4,450 acres of eroded, ephemeral washes and upland areas that are within a mile of the San Pedro River within the San Pedro Riparian National Conservation Area. This was accomplished by recontouring ephemeral washes and adjacent uplands and by

revegetating these areas with native plant species. The project was completed in April 2000.

- San Pedro Riparian National Conservation Area Watershed Protection and Improvement Project – The BLM was awarded funds to improve, enhance and protect the riparian habitats and water quality in the San Pedro National Riparian Conservation Area. Part of the funds were spent on fencing off 36 miles of the San Pedro River from livestock. This project will enhance the riparian ecosystem and associated wildlife habitats without undue impacts to upland grazing allotments. The project was completed in September 1998.
- San Pedro River Preserve Riparian Habitat Restoration Project – The intent of this project is to enhance and protect existing riparian forest along three miles of the San Pedro River. The Nature Conservancy restored native grassland communities on the river slopes and terraces, determined the need for mechanical stabilization measures and implemented measures to stabilize river banks and re-established native riparian vegetation in areas of defunct aquiculture ponds and agricultural fields on a site encompassing 860 acres. The Conservancy also developed and demonstrated new techniques for restoring abandoned agriculture fields to riparian habitat. The project was completed in August 2001.
- Teran Watershed Enhancement Project – The Redington Natural Resource Conservation District received funds to improve watershed conditions within the Teran sub-watershed, located along the San Pedro River. Thousands of small, loose-rock dam structures have been constructed in an attempt to reduce surface water runoff rates, increase duration of channel flow, improve ground water recharge and enhance habitat for wildlife. The project was completed in April 1999.
- Klondyke Tailings Response Strategy Analysis – A team of scientists led by ADEQ collected data to determine the extent of impact on Aravaipa Creek from runoff or leaching of contaminated mine tailings at the Klondyke Mine tailings pile. The team developed a response

strategy to determine the best methods of treating the tailings pile to reduce or prevent ground water and stream contamination by leaching, runoff or erosion of the tailings into the stream. This investigation was completed in 1998.

- Happy Valley Riparian Restoration Area Restoration Project – The Paige Creek riparian area in Happy Valley is a unique, large riparian gallery located on the east side of the Rincon Mountains. The Coronado National Forest received a grant to fence the riparian area, create upland water sources for grazing wildlife, construct an in-stream structure to reduce water velocity, and construct a pipe barrier fence to restrict vehicle access to sensitive areas. This project which was completed in July 1999.
- Lyle Canyon Allotment Restoration Project – A private land owner was awarded funds to restore and protect the riparian areas on the Lyle Canyon Allotment through the installation of a variety of range improvements, including fences and upland water developments that will better distribute cattle grazing in the upland portions of the allotment and away from the riparian areas. The grantee and the University of Arizona Cooperative Extension Office have developed a monitoring plan to record the condition of riparian and upland habitats on the Lyle Canyon Allotment. The monitoring plan includes a quantitative assessment of the riparian and upland vegetation, a “Proper Functioning Condition” assessment of the riparian areas, and photo point monitoring. If livestock grazing management changes are indicated by the monitoring data the grantee will coordinate with the U.S. Forest Service to incorporate those into the Allotment Management Plan. The project was completed in October 2001.

**Water Quality Improvement Grants** – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Upper Whitewater Draw Treatment and Management Project – The Whitewater Draw Natural Resource Conservation District received a grant to reduce erosion and siltation and enhance riparian conditions within Whitewater Draw through the following actions:
  - < Improve understory and range vegetation by 50% or greater on 160 acres within the upper Whitewater Draw project area

due to brush management techniques such as clearing and snagging;

- < Implement livestock rotation and exclusion range management practices;
- < Install 6000 feet of contoured swales;
- < Add fluvial geomorphology and grade stabilization structures;
- < Repair a flood retarding structure; and
- < Install several small rock weirs as grade stabilization structures.

An educational and outreach component is also present. The project is scheduled for completion in 2002.

- San Pedro Watershed Stewardship Project – The Arizona Association of Conservation Districts received funds to reduce erosion and siltation and enhance riparian conditions and stream channel stability within the San Pedro River and its tributaries. Along with an educational component, the following actions are to be completed in 2002:
  - < Install grade stabilization structures and reshape a portion of a tributary channel; and
  - < Replant several riparian and flood plain areas with native plant species (range seeding).
- Turbidity Reduction in Aravaipa Creek Through a Watershed Treatment Project – Coronado Resource Conservation and Development was awarded a grant to address sheet and rill erosion in a 60,000 acre drainage area along the headwaters of Aravaipa Creek. Slowing the rate of runoff reaching existing gullies along the creek will keep the gullies from increasing in size. The objective of slowing runoff by improving vegetation in the lower areas will be met by implementing the following management practices:
  - < Install fencing to divide the area into smaller pastures with water supplied in the uplands encouraging cattle to utilize these areas;
  - < Adjust grazing practices so that a higher concentration of cattle will be on each pasture for a shorter length of time. This should improve soil tilth, and allowing seed germination and vegetative regrowth; and
  - < Use fencing to limit cattle access to the creek. This should



result in enhanced riparian vegetation that traps sediment and multiple benefits to wildlife.

A second phase is being planned which will address existing gullies and head cuts. Establishment of a riparian community will play a key role in both phases of erosion treatment in the area through its role in bank stabilization and sediment trapping to reduce turbidity and provide cleaner water to the system.

- Borderlands Storm Water Runoff Control Project – A 2500 acre parcel, between the international border with Mexico and the San Pedro River, will undergo range seeding to increase vegetation and act as a sediment control buffer strip. This should reduce degradation of the Bureau of Land Management's San Pedro Riparian National Conservation Area. The Coronado Resource Conservation and Development is coordinating the implementation of this project with the San Jose Ranch, Hereford Natural Resource Conservation District, the Bureau of Land Management, and the Natural Resource Conservation Service. This project is scheduled for completion in 2003.
- Peppersauce Cave and Cave Water Restoration Project – Peppersauce Cave in Coronado National Forest has permanent pools in three rooms. Two water samples indicated the presence of fecal coliform and *Escherichia coli* contamination. Peppersauce Cave is easily the most visited wild cave in Arizona with the US Forest Service reporting up to 23,000 visits per year. The grant will be used to clean the water, remove the litter and graffiti, create and distribute educational material to reverse the long-standing destruction, erect a kiosk, and encourage current users of the cave to help in these efforts. This project is to be completed in 2003.

**Sonoran Desert Conservation Plan** -- Pima County developed the Sonoran Desert Conservation Plan in 1999. The objective of the plan is to coordinate short-term actions through long-range planning to ensure that natural and urban environments not only coexist but develop an interdependent relationship where one enhances the other. The action plan is to guide approved public bond investment and preservation actions, establish federal program and funding priorities, and develop our region's preference for the expenditure of state funds to preserve and protect State Trust lands threatened by urbanization. The following projects are associated with this plan:

- Bingham Cienega Riparian Restoration Project -- In the summer of 1998, Pima County and the Nature Conservancy began a three-year project to restore sacaton grasslands, willow forests, and mesquite woodland, at Bingham Cienega Natural Preserve. With help from volunteers and a wide variety of state, federal, and private funding, 50 acres of former farm fields are being transformed to native vegetation with benefits expected for water quality.
- The Bingham Cienega Natural Preserve – This preserve was established when the Pima County Flood Control District acquired lands along the San Pedro River to preserve a natural spring-fed marsh known as the Bingham Cienega. Because of the site's remote location and sensitive environment, the district entered into a long-term agreement with The Nature Conservancy to manage the property. Conservancy volunteers fenced out livestock, and once vegetation began to fill in drainage channels, the marsh began to spread. The District installed a small check dam that has successfully arrested erosion that threatened rapid sedimentation of the marsh.
- San Pedro River Protection Project -- Further protection of the San Pedro River is proposed. In conjunction with the Arizona Chapter of the Nature Conservancy, Pima County will acquire additional land or conservation easements along the San Pedro River from willing sellers. Bonds in the amount of \$1 million will be sold to preserve riparian areas near Bingham Cienega and Buehman Canyon. Additional lands may also be set aside. The protection and/or restoration of riparian corridors will serve to slow runoff and reduce excessive sedimentation of the San Pedro River while enhancing habitat for native wildlife.
- Other water course protection projects will be explored when the Pima County Flood Control District works with landowners to protect the flood prone areas from future development through conservation easements and acquisitions. Using bonds approved by voters in 1997, lands along Sabino Creek, Honey Bee Wash, Bear Canyon, Tanque Verde Wash, San Pedro River, and Agua Caliente Wash will be preserved, protecting and/or enhancing water quality. Pima County will encourage the setting aside of state trust land along significant corridors such as Cienega Creek, Mescal Arroyo, Davidson, and

Penitas Wash, among others.

**The US Fish and Wildlife Service Aravaipa Creek Study** – The USFWS analyzed fish tissue to document and assess current levels of selected metal contaminants in fish from Aravaipa Creek and trends in contaminants by comparing the results with data collected by ADEQ in 1993. Samples were collected from the Nature Conservancy property on Aravaipa Creek in 1997. Although arsenic, cadmium, and lead were detected in the fish well above background, none were at concentrations likely to adversely affect fish health and reproduction. Mercury was not even detected in the fish samples (lab detection level was 0.25 µg/g).

## Ground Water Studies and Mitigation Projects

**Ground Water Quality in the Sierra Vista Subbasin, Arizona** – Thirty-nine ground water samples were collected and analyzed in 1996-1997 by the U.S. Geological Survey and ADEQ for the purpose of assessing ground water quality and contaminant source identification within the Sierra Vista subbasin. Review of analytical results indicated that fluoride, iron, manganese, pH, sulfate, and total dissolved solids exceeded state water quality standards. Significant variation was observed in ground water quality with respect to well location, well depth and aquifer type; however, sodium, fluoride, and potassium concentrations were higher in the northern part of the subbasin as compared to the southern. For more information, please contact the ADEQ Ground water Monitoring Unit at (602) 771-4412.

**Willcox Basin Baseline Study** – The Willcox Basin is 1,911 square miles area delineated by rugged mountains at its fringes and a 29,500 acre playa in its center. The majority of groundwater pumped is for irrigation use. Ground water generally flows from mountain fronts toward the Willcox playa, though heavy irrigation pumping has partially altered this flow and created ground water depressions in intensively farmed areas.

ADEQ conducted a regional ground water quality study of the Willcox Basin in 1999. A total of 58 sites were sampled: 41 randomly-selected sites and 17 targeted sites. Sites were targeted to investigate arsenic and fluoride levels northeast of Willcox and the relationship of parameter concentrations to ground water depth in the Kansas Settlement District. Of the 58 sites sampled, 21 had parameter levels exceeding Arizona's Ground Water Protection Standards

**(Figure 77).** Well owners should be particularly concerned about elevated parameter concentrations in the following portions of the basin:

- Fluoride, arsenic, and pH near the Spike E. Hills northeast of Willcox;
- Gross alpha in areas of granitic rock throughout the basin;
- Nitrate, fluoride, and sulfate northwest of Sulphur Hills; and
- Chloride and sulfate west of the Willcox Playa.

Although only limited trend analyses were conducted, parameters in most of the basin do not appear to vary significantly in the short term. However, trends in the Kansas Settlement District indicate that ground water quality seems to be influenced by nitrate and salts carried by excess irrigation water that ultimately recharges the ground water.

**Douglas Basin Baseline Study** – This basin covers 950 square miles and extends south hydrologically into Mexico; however the international border serves as the southern edge of this basin for reporting purposes. This basin includes Bisbee and Douglas which were historically important copper mining and or processing centers and Elfrida and McNeal which are agriculturally-oriented small towns.

To characterize regional ground water quality, 51 sites were sampled: 29 randomly-selected sites and 22 targeted sites. Out of the 51 sites, only three sites exceeded Arizona's Aquifer Protection Standards: arsenic (1 site) beryllium (1 site) and nitrate (1 site).

Nitrate was elevated over 3 mg/L at 21 of the sites, with may indicate impacts from human activities. Areas with the highest nitrate levels included the intensively farmed areas near Elfrida and in the foothills of both the Dragoon and Mule mountains.

Four areas were targeted for more intensive sampling to examine potential effects on ground water quality from various land uses:

- No effects from a landfill near Elfrida were discerned; however, six of the nine targeted wells had elevated nitrate levels. Agricultural activities and septic systems were assumed to be the source of the elevated nitrates;
- Mine tailings appear to be contributing to elevated sulfate in the



- ground water down gradient of the town of Bisbee;
- Six sites near Douglas showed no impacts from either municipal activities or slag waste from a copper smelter; and
- A targeted area east of the Bisbee-Douglas Airport unexpectedly showed influences from geothermal activities with very high temperatures, and high levels of total dissolved solids (14,000 mg/L), sulfate (5,020 mg/L), ammonia (1.09 mg/L), and iron (13.9 mg/L).

Although ground water in the basin generally met water quality standards, ADEQ suggests that well owners periodically have their ground water analyzed by a certified laboratory.

**Federal and State Superfund Cleanup Sites** – Three Superfund and Department of Defense cleanup sites are located in this watershed.

- Klondyke Tailings – In the unincorporated community of Klondyke, this site is located on the north bank of Aravaipa Creek, approximately 4.5 miles upstream of the Aravaipa Canyon Wilderness Area. The site encompasses two piles of mine tailings and adjacent soil, including an area approximately 50 feet into the stream bed of Aravaipa Creek.

The site was listed on the WQARF registry in 1998 due to various metals left in the tailings. Metals present at concentrations higher than Arizona's Aquifer Protection and Soil Remediation standards include: lead, cadmium, antimony, beryllium, copper, manganese, and arsenic. There is physical evidence that runoff, leaching, and flood erosion of contaminated tailings may be impacting Aravaipa Creek; however, no water quality samples were available for assessment purposes. This project is still in the investigation phase.

- Apache Powder – The Apache Powder Superfund site is located approximately two and a half miles southwest of St. David, Arizona. The site covers approximately nine square miles, including 945 acres of land owned by Apache Nitrogen Products, Inc. (formerly known as the Apache Powder Company). The San Pedro River bounds the eastern side of the site. Contaminants of concern found at this site include: arsenic, fluoride, and nitrate in the perched aquifer; nitrate in the shallow aquifer; arsenic, antimony, barium, beryllium, chromium, lead,

manganese, and nitrate in the inactive pond soils and sediments; and two variants of dinitroglycerine and lead in "wash area 3." Additionally, vanadium pentoxide and trinitroglycerine were found in the soils on the site and perchlorate has been found in the perched and shallow aquifers.

- Fort Huachuaca – The Department of Defense has been studying Fort Huachuaca, an US Army post located in Sierra Vista. Originally 20 hazardous waste and leaking underground storage tank sites were identified. Of these, fifteen have been cleaned up or require no further action, and only five sites are undergoing remediation or further monitoring.

## Watershed Partnerships

**The Upper San Pedro Partnership** -- This partnership was formed to facilitate and implement sound water resource management and conservation strategies in the Sierra Vista area within the Upper San Pedro River Groundwater Basin. It is a consortium of agencies that own or manage water resources in the Sierra Vista area and agencies that can provide resources to help the partnership accomplish its purpose.

The purpose of the Upper San Pedro Partnership is to coordinate and cooperate in the identification, prioritization and implementation of comprehensive policies and projects to assist in meeting water needs in the Sierra Vista sub-watershed of the Upper San Pedro River Basin. Although the general focus of the partnership concentrates on issues pertaining to water quantity, water quality issues are also a component. For more information on the Upper San Pedro Partnership, please contact George Michael at (520) 378-4046.

**The Middle San Pedro Partnership** – This is a newly formed partnership focused on improving water quality of the Middle San Pedro River through the implementation of Water Quality Improvement Grant projects and cooperation with local land owners. For more information on the Middle San Pedro Partnership, please contact Barbara Clark at (520) 212-2529.

**Campomoch-Sacaton Watershed Group** – The Campomoch-Sacaton Watershed Group is also a newly formed organization focused on improving water quality of the Middle and Lower San Pedro River through the

implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in this watershed group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Arizona State Land Department, Cochise County, City of Willcox, Arizona Cattlegrowers, Arizona Game and Fish Department, Coronado Resource Conservation & Development, Willcox-San Simon Conservation District, and the University of Arizona Extension. A principle contact has not been appointed to date.

**Cottonwood Canyon Watershed Group** – This work group is a newly formed and focused on improving water quality and restoring the flow of Cottonwood Creek through the implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in the Cottonwood Canyon Watershed Group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Willcox-San Simon Natural Resource Conservation District, Cochise County, Coronado Resource Conservation & Development, Sunglow Guest Ranch, Smith Ranch and the University of Arizona Extension. A principle contact has not been appointed to date.